



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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(21) International Application Number: PCT/AU86/00318 (22) International Filing Date: 21 October 1986 (21.10.86) (31) Priority Application Number: PH 3441 (32) Priority Date: 15 November 1985 (15.11.85) (33) Priority Country: AU (71) Applicant (for all designated States except US): AL- TRACK LIMITED [AU/AU]; 160 St. George's Ter- race, 4th Floor, Perth, WA 6000 (AU). (72) Inventor; and (75) Inventor/Applicant (for US only) : BURNS, Alan, Ro- bert [AU/AU]; 189 Wellington Street, Mosman Park, WA 6012 (AU). (74) Agents: HARWOOD, Errol, John et al.; Wray & Asso- ciates, P.O. Box 6292, Hay Street East, Perth, WA 6000 (AU).		(81) Designated States: AT (European patent), AU, BB, BE (European patent), BG, BR, CF (OAPI patent), CG (OAPI patent), CH (European patent), CM (OAPI patent), DE (European patent), DK, FI, FR (Euro- pean patent), GA (OAPI patent), GB (European pa- tent), HU, IT (European patent), JP, KP, KR, LK, LU (European patent), MC, MG, ML (OAPI patent), MR (OAPI patent), MW, NL (European patent), NO, RO, SD, SE (European patent), SN (OAPI patent), SU, TD (OAPI patent), TG (OAPI patent), US. Published <i>With international search report.</i> <i>With amended claims and statement.</i>
(54) Title: GROUND ENGAGING SURFACE FOR ENDLESS TRACKS, WHEELS AND TYRES <div data-bbox="451 1199 1284 1787"> </div> (57) Abstract An endless track (27) for tracked vehicles comprising an endless flexible band (33) and a plurality of spaced elongat- ed tread elements (41) provided on the outer surface of the band. Each tread element (41) is formed of resilient material and extends transversely of the direction of travel of the track. The tread elements (41) are each in the form of a loop hav- ing a ground engaging portion and a pair of side wall portions which are load supporting when the loop is in contact with the ground. The tread elements (41) may be formed integral with, or formed separately of and secured to, the endless flexi- ble band (33). A track assembly is also described and claimed.		

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"GROUND ENGAGING SURFACE FOR ENDLESS TRACKS, WHEELS AND TYRES"

THIS INVENTION relates to an endless track for a tracked vehicle, and to a track assembly for a tracked vehicle.

As traction means for vehicles, the benefits of endless tracks as opposed to ground wheels provided with pneumatic tyres, are well known. These benefits include better traction in soil and less ground compaction. However, endless tracks do have several deficiencies. The endless track comprise track sections joined to one another by pivotted connections which are prone to unacceptably high rates of wear, thereby limiting the service life of the tracks. A further deficiency is that endless tracks cause damage to finished road surfaces, especially when the vehicle is turning. A still further deficiency is that endless tracks are incapable of cushioning or absorbing shocks resulting from surface irregularities and so vehicle springing is required for satisfactory ride characteristics. The endless tracks also have higher noise levels and lower maximum travel speeds than wheels equiped with pneumatic tyres.

With a view to overcoming some of the above-mentioned deficiencies, there have been various proposals to provide the endless tracks with ground contacting elements formed of elastomeric material rather than metal. While elastomeric ground contacting elements do allow tracked vehicles to travel on finished roads, they do not extend the service life of the tracks as the tracks are still formed of track sections joined to one another by pivotted connections which are susceptible to high rates of wear. Moreover, so as to have a useful service life, the elastomeric elements are solid and not sufficiently resilient to provide effective cushioning of shocks resulting from bumps and surface irregularities encountered by the tracks.

It is an object of the present invention to provide a useful and novel track which is of relatively simple construction, which may travel on finished road surfaces and which can at least partly absorb shocks resulting from encountering bumps and surface irregularities.

According to a first aspect of the invention there is provided an endless track for tracked vehicles comprising an endless flexible band having an inner surface and an outer surface, and a plurality of spaced elongated tread elements provided on the outer surface of the band, each tread element being formed of resilient material and extending transversely of the direction of travel of the track.

The use of the endless flexible band obviates the need for track sections joined to one another by pivoted connections and so provides for an endless track of relatively simple construction. Furthermore, the resilient nature of the tread elements permits the track to travel on finished road surfaces and provides at least some cushioning of shocks encountered during travel.

Preferably, each tread element is hollow so as to define a cavity which preferably is unpressurised.

The tread elements may be formed integral with, or formed separately of and secured to, the endless flexible band.

Preferably, each tread element is in the form of a loop having a ground engaging portion and a pair of side wall portions which are load supporting when the loop is in contact with the ground.

Preferably, the loops are open at their ends. In this way, the cavities defined within the loops open onto the exterior of the endless track.

Preferably, the loops are formed of reinforced elastomeric material.

Preferably, the endless band is formed of reinforced elastomeric material so as to be substantially longitudinally inextensible yet flexible.

Each loop may be provided with a sacrificial wear pad attached to the ground engaging portion thereof.

In one arrangement, the loops are provided by a length of resilient material arranged in a sinuous formation having alternating crests and troughs, the length of resilient material being anchored to the flexible band at locations corresponding to at least some of the troughs.

According to a second aspect of the invention there is provided a track assembly for a tracked vehicle, the track assembly comprising a plurality of track wheels at least one of which constitutes a drive wheel, and an endless track entrained around the track wheels, the endless track being in accordance with the first aspect of the invention as defined hereinbefore.

Although a positive drive may be provided between the or each drive wheel and the track, it is preferred that friction drive be employed. With friction drive, there is frictional engagement between the inner surface of the endless band and the outer periphery of the or each drive wheel so that the drive wheel frictionally transmits

power to the endless track. To facilitate frictional engagement between the drive wheel and the endless band, the outer periphery of the drive wheel may be coated with elastomeric material.

Preferably, the track wheels are each provided with a circumferential recess which receives the endless band and serves to guide the band in its circuitous path around the track wheels.

Preferably, a tensioning means is provided for tensioning the endless band about the track wheels. The tensioning means may comprise means for urging one of the endmost track wheels in a direction away from the other endmost track wheel.

The invention will be better understood by reference to the following description of one specific embodiment thereof as shown in the accompanying drawings in which:

Figure 1 is a perspective view of a work vehicle provided with traction means incorporating an endless track assembly according to the embodiment;

Figure 2 is a schematic side view of the work vehicle of figure 1 with the lower run of the endless track assembly shown in the condition it assumes under driving load;

Figure 3 is a view of the track assembly in part section;

Figure 4 is a detail view of part of the upper run of an endless track of the track assembly; and

Figure 5 is a detail view of part of the lower run of the endless track, deformed under driving load.

Referring to figure 1 of the drawings, there is shown an amphibious work vehicle 11 having a traction means which includes a pair of track assemblies 13 according to the embodiment arranged on opposite sides of the vehicle. The vehicle is provided with a frame structure 15 and a body 17 which is carried on the frame structure and which provides an operator's cab 19, an engine compartment 21, and a load carrying compartment 23.

Each track assembly 13 comprises a plurality of track wheels 25 and an endless track 27 fitted onto the track wheels. The track wheels 25 are supported on axles which are directly connected to the frame structure of the vehicle; that is, there is no spring system between the frame structure and the axles.

One of the endmost track wheels constitutes a drive wheel to which power is selectively transmitted from an engine mounted in the engine compartment.

A tensioning means (not shown) is provided for tensioning the endless belt about the track wheels. The tensioning means is the form of a means supporting the particular endmost track wheel which is not the drive wheel on the frame structure for movement along the fore-and-aft direction of the vehicle, and a power device (such as a hydraulic ram) for controlling such movement. With this arrangement, the movable endmost wheel can be moved in the direction away from the drive wheel thereby to tension the endless track, as will become more apparent later.

The track wheels 25 (including the drive wheel) are each provided with a circumferential recess 29 to guidingly

receive the endless track for retaining the track in alignment with the track wheels. The recesses 29 are formed by circumferential flanges 31 provided on the ends of the track wheels, as best seen in figure 3 of the drawings.

The endless track 27 comprises an endless flexible band 33 having an outer face 35, an inner face 37 and two longitudinal edges.

The endless band 33 is received in the circumferential recesses 29 of the track wheels 25 with the longitudinal edges of the band closely adjacent the circumferential flanges 31 of the track wheels.

While being flexible, the endless band 33 is also longitudinally inextensible in character so as to resist undue stretching. To this end, the endless band may be in the form of an elastomeric material reinforced with steel cables or other reinforcing elements.

The endless track 27 further comprises a plurality of spaced, elongated tread elements 41 provided on the outer face of the endless band. The tread elements 41 are formed of resilient material and extend transversely of the direction of travel of the vehicle. Each tread element 41 is in the form of a loop having a ground contacting portion 43 and a pair of side wall portions 45 which are load supporting when the tread element is in contact with the ground.

While the tread elements 41 may be formed integrally with the endless band 33, in this embodiment the tread elements are formed separately of and secured to the

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band. More particularly, the tread elements are provided by a length 47 of resilient material which is arranged in a sinuous formation having alternate crests and troughs. Fastening means 49 secure the length of material 47 to the endless band 33 at locations corresponding to each of the troughs. The resilient material is required to have sufficient compressive strength to support the loads imposed on it when the loops are under load and to this end may be in the form of reinforced elastomeric material.

The outer periphery of the drive wheel is provided with a friction surface for frictional engagement with the inner surface of the endless band. In this way, the drive wheel frictionally transmits power to the endless band. Tension in the endless band is regulated by the tensioning means so as to maintain the frictional driving relationship between the endless band and the drive wheel.

A scraper (not shown) or other means may be provided to displace sand and other debris gathering between the inner surface of the endless band and the outer peripheries of the track wheels.

The ground contacting portion of each loop may be provided with a sacrificial wear pad (not shown) if desired so as to extend the service life of the endless track.

In operation, the tread elements deform under load and assume a configuration illustrated in figure 5 when the vehicle is undergoing straight line motion. When the vehicle is turning on finished road surfaces, the tread elements twist and drag over the surface without inflicting damage thereto.

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The ability of the tread elements to deform under load provides the vehicle with a degree of springing which at least partially absorbs shock forces resulting from bumps and other surface irregularities encountered in the path of the vehicle.

The traction means also provides a propulsion system for the vehicle when operating in water. In such situations, the lower run of the endless track is submersed and the upper run is above the water line. In this way, the tread elements act as paddles as the endless track follows its circuitous path.

From the foregoing, it is evident that the present invention provides both an endless track assembly and an endless track, each of which is of relatively simple construction and which can be operated on finished road surfaces without inflicting damage to such surfaces.

Although the invention has been described as applied to an amphibious work vehicle, it will be recognised that it may be applied to any suitable tracked vehicle including earth-moving machines, agricultural machines and snowmobiles.

THE CLAIMS defining the invention are as follows:-

1. An endless track for tracked vehicles comprising an endless flexible band having an inner surface and an outer surface, and a plurality of spaced elongated tread elements provided on the outer surface of the band, each tread element being formed of resilient material and extending transversely of the direction of travel of the track.
2. An endless track according to claim 1 wherein each tread element is hollow so as to define a cavity.
3. An endless track according to claim 2 wherein the cavity is unpressurised.
4. An endless track according to any one of the preceding claims wherein the endless band is formed of reinforced elastomeric material so as to be substantially longitudinally inextensible yet flexible.
5. An endless track according to any one of the preceding claims wherein each tread element is in the form of a loop having a ground engaging portion and a pair of side wall portions which are load supporting when the loop is in contact with the ground.
6. An endless track according to claim 5 wherein the loops are open at their ends.
7. An endless track according to claim 5 or 6 wherein the loops are formed of reinforced elastomeric material.
8. An endless track according to any one of the preceding claims wherein the tread elements are formed integral with the endless band.

9. An endless track according to any one of the claim 1 to 7 wherein the tread elements are formed separately of and secured to the endless band.

10. An endless track according to claim 9 as dependent on claim 5, 6 or 7 wherein the loops are provided by a length of resilient material arranged in a sinuous formation having alternating crests and troughs, the length of material being anchored to the flexible band at locations corresponding to at least some of the troughs.

11. A track assembly for a tracked vehicle, the track assembly comprising a plurality of track wheels at least one of which constitutes a drive wheel, and an endless track according to any one of the preceding claims entrained around the track wheels.

12. A track assembly according to claim 11 wherein a friction drive is provided between the or each drive wheel and the endless band.

13. A track assembly according to claim 11 or 12 wherein the track wheels are each provided with a circumferential recess which receives the endless band and serves to guide the band in its circuitous path around the track wheels.

14. A track assembly according to claim 11, 12 or 13 wherein a tensioning means is provided for tensioning the endless band about the track wheels.

15. A track assembly according to claim 14 wherein the tensioning means comprises means for urging one of the endmost track wheels in a direction away from the other endmost track wheel.

16. An endless track substantially as herein described with reference to the accompanying drawings.

17. An endless track assembly substantially as herein described with reference to the accompanying drawings.

AMENDED CLAIMS

[received by the International Bureau on 03 April 1987 (03.04.87);
original claims 1-17 replaced by amended claims 1-19 (3 pages)]

1. (Amended). An endless track for tracked vehicles comprising an endless flexible band having an inner surface and an outer surface, and a plurality of spaced elongated tread elements provided on the outer surface of the band and extending transversely across the band, the tread elements being in the form of resiliently deflectable loops that engage the ground.
2. (Cancelled).
3. (Cancelled).
4. An endless track according to any one of the preceding claims wherein the endless band is formed of reinforced elastomeric material so as to be substantially longitudinally inextensible yet flexible.
5. (Cancelled).
6. (Amended). An endless track according to claim 1 or 4 wherein the loops are open at their ends.
7. (Amended). An endless track according to claim 6 wherein the loops are formed of reinforced elastomeric material.
8. An endless track according to any one of the preceding claims wherein the tread elements are formed integral with the endless band.
9. An endless track according to any one of claims 1 to 7 wherein the tread elements are formed separately of and secured to the endless band.

10. (Amended). An endless track according to claim 9 wherein the loops are provided by a length of resilient material arranged in a sinuous formation having alternating crests and troughs, the length of material being anchored to the flexible band at locations corresponding to at least some of the troughs.

11. A track assembly for a tracked vehicle, the track assembly comprising a plurality of track wheels at least one of which constitutes a drive wheel, and an endless track according to any one of the preceding claims entrained around the track wheels.

12. A track assembly according to claim 11 wherein a friction drive is provided between the or each drive wheel and the endless band.

13. A track assembly according to claim 11 or 12 wherein the track wheels are each provided with a circumferential recess which receives the endless band and serves to guide the band in its circuitous path around the track wheels.

14. A track assembly according to claim 11, 12 or 13 wherein a tensioning means is provided for tensioning the endless band about the track wheels.

15. A track assembly according to claim 14 wherein the tensioning means comprises means for urging one of the endmost track wheels in a direction away from the other endmost track wheel.

16. An endless track substantially as herein described with reference to the accompanying drawings.

17. An endless track assembly substantially as herein described with reference to the accompanying drawings.

18. A tracked vehicle having an endless track according to any one of claims 1 to 10.

19. A tracked vehicle having a track assembly according to any one of claims 11 to 15.

STATEMENT UNDER ARTICLE 19

Claims 1, 6, 7 and 10 have been amended. The amendment has been made in order to more clearly distinguish the applicant's invention from the citations in the international search report.

The amendment includes the cancellation of claims 2, 3 and 5.

New claims 18 and 19 have been included.

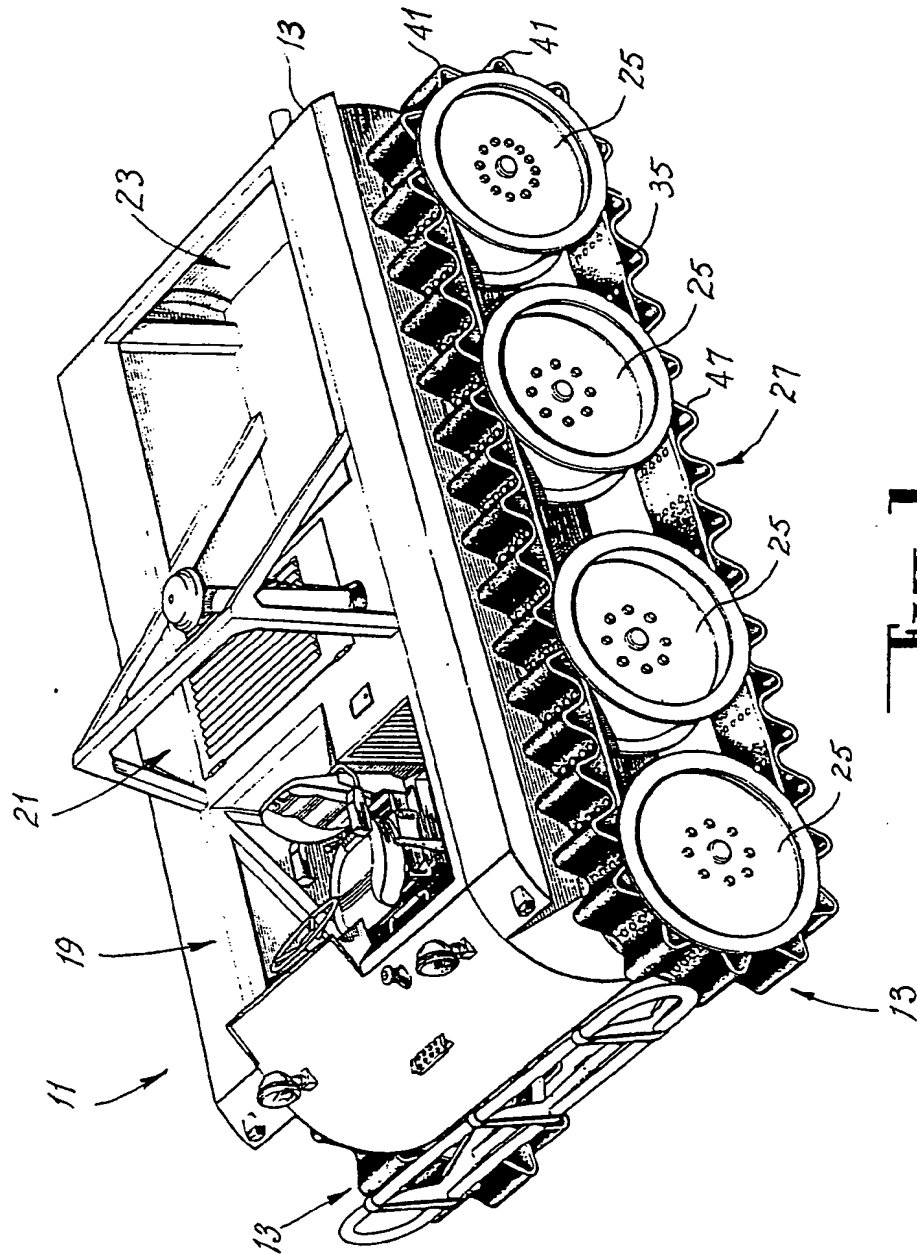
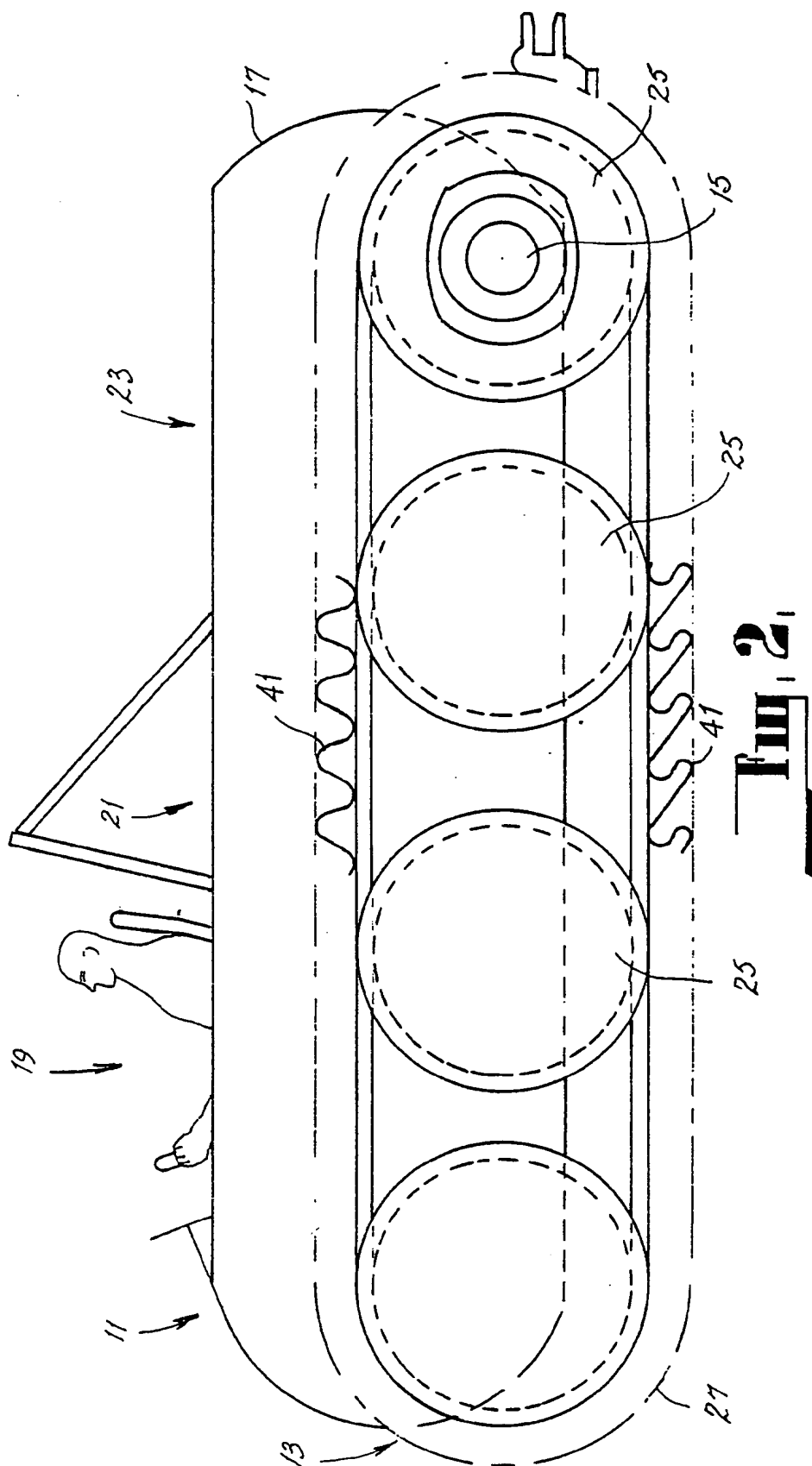


Fig. 1.



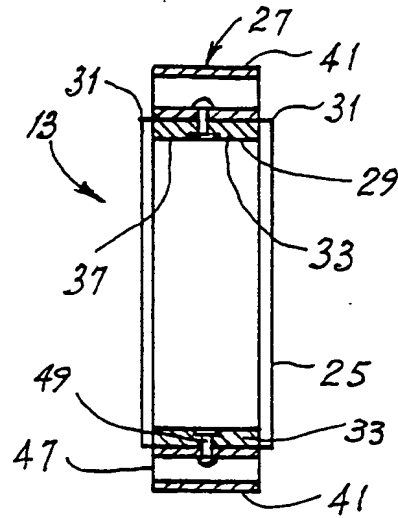


Fig. 3

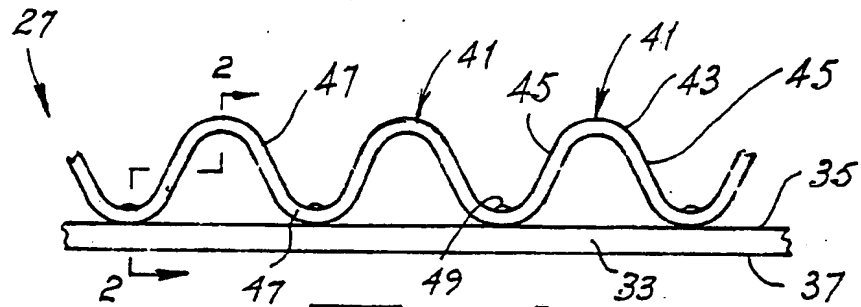


Fig. 4

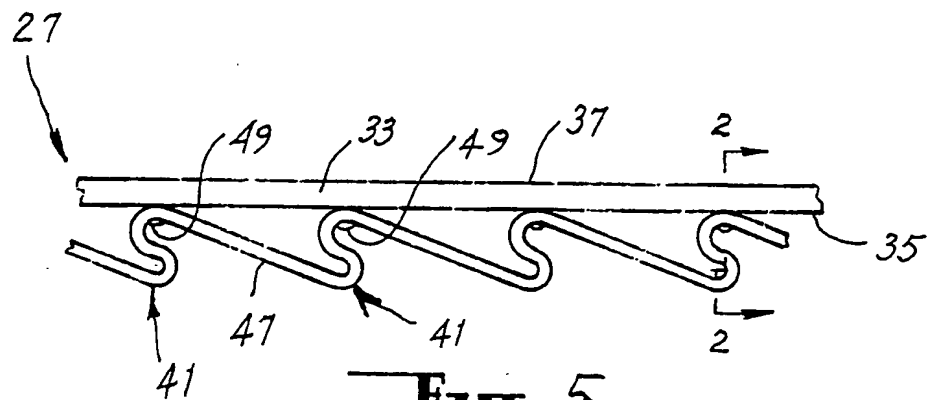


Fig. 5

INTERNATIONAL SEARCH REPORT

International Application No PCT/AU 86/00318

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC <div style="display: flex; justify-content: space-between; width: 80%; margin-top: 5px;"> Int. Cl.⁴ B62D 55/24 </div>																													
II. FIELDS SEARCHED <div style="text-align: center; margin-top: 5px;">Minimum Documentation Searched ⁷</div> <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <tr> <th style="width: 30%;">Classification System</th> <th style="width: 70%;">Classification Symbols</th> </tr> <tr> <td style="text-align: center; padding: 5px;">IPC</td> <td style="text-align: center; padding: 5px;">B62D 55/24</td> </tr> </table> <div style="text-align: center; margin-top: 5px; font-size: small;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸</div>			Classification System	Classification Symbols	IPC	B62D 55/24																							
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IPC	B62D 55/24																												
AU : IPC as above; Australian Classification 93.5																													
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹ <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <tr> <th style="width: 10%;">Category ¹⁰</th> <th style="width: 70%;">Citation of Document, ¹¹ with Indication, where appropriate, of the relevant passages ¹²</th> <th style="width: 20%;">Relevant to Claim No. ¹³</th> </tr> <tr> <td style="text-align: center;">X</td> <td>US,A, 3074764 (BERTELSEN) 22 January 1963 (22.01.63)</td> <td style="text-align: center;">(1,4,8)</td> </tr> <tr> <td style="text-align: center;">X</td> <td>US,A, 3747995 (RUSS) 24 July 1973 (24.07.73)</td> <td style="text-align: center;">(1,4,8)</td> </tr> <tr> <td style="text-align: center;">X</td> <td>US,A, 3762779 (RUSS) 2 October 1973 (02.10.73)</td> <td style="text-align: center;">(1,4,8)</td> </tr> <tr> <td style="text-align: center;">X</td> <td>DE,A, 1480857 (VEBIFA GETRIEBEWERKE BRANDENBURG) 22 May 1969 (22.05.69)</td> <td style="text-align: center;">(1,4,8,11)</td> </tr> <tr> <td style="text-align: center;">X</td> <td>GB,A, 912254 (THE GOODYEAR TYRE & RUBBER COMPANY) 5 December 1962 (05.12.62)</td> <td style="text-align: center;">(1,4,8,11,13)</td> </tr> <tr> <td style="text-align: center;">X</td> <td>WO,A, 85/01710 (BURMEISTER) 25 April 1985 (25.04.85)</td> <td style="text-align: center;">(1,2,4,5,8,11,12)</td> </tr> <tr> <td style="text-align: center;">X</td> <td>FR,A, 810806 (DAMPIERRE) 31 March 1937 (31.03.37)</td> <td style="text-align: center;">(1,2,4,5,8,11,12)</td> </tr> <tr> <td style="text-align: center;">A</td> <td>US,A, 4469379 (KOTYUK) 4 September 1984 (04.09.84)</td> <td style="text-align: center;">(1,4,8,11)</td> </tr> </table>			Category ¹⁰	Citation of Document, ¹¹ with Indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	X	US,A, 3074764 (BERTELSEN) 22 January 1963 (22.01.63)	(1,4,8)	X	US,A, 3747995 (RUSS) 24 July 1973 (24.07.73)	(1,4,8)	X	US,A, 3762779 (RUSS) 2 October 1973 (02.10.73)	(1,4,8)	X	DE,A, 1480857 (VEBIFA GETRIEBEWERKE BRANDENBURG) 22 May 1969 (22.05.69)	(1,4,8,11)	X	GB,A, 912254 (THE GOODYEAR TYRE & RUBBER COMPANY) 5 December 1962 (05.12.62)	(1,4,8,11,13)	X	WO,A, 85/01710 (BURMEISTER) 25 April 1985 (25.04.85)	(1,2,4,5,8,11,12)	X	FR,A, 810806 (DAMPIERRE) 31 March 1937 (31.03.37)	(1,2,4,5,8,11,12)	A	US,A, 4469379 (KOTYUK) 4 September 1984 (04.09.84)	(1,4,8,11)
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>¹⁴ Special categories of cited documents: ¹⁵</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"A" document member of the same patent family</p> </div> </div>																													
IV. CERTIFICATION <table border="1" style="width: 100%; border-collapse: collapse; margin-top: 5px;"> <tr> <td style="width: 50%; padding: 5px;"> Date of the Actual Completion of the International Search 22 January 1987 (22.01.87) </td> <td style="width: 50%; padding: 5px;"> Date of Mailing of this International Search Report <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; border-radius: 50%; padding: 2px 5px; margin-right: 5px;">03.02.87</div> 3 FEBRUARY 1987 </div> </td> </tr> <tr> <td style="width: 50%; padding: 5px;"> International Searching Authority Australian Patent Office </td> <td style="width: 50%; padding: 5px;"> Signature of Authorized Officer <div style="display: flex; align-items: center; margin-top: 10px;"> T. FAIRALL </div> </td> </tr> </table>			Date of the Actual Completion of the International Search 22 January 1987 (22.01.87)	Date of Mailing of this International Search Report <div style="display: flex; align-items: center;"> <div style="border: 1px solid black; border-radius: 50%; padding: 2px 5px; margin-right: 5px;">03.02.87</div> 3 FEBRUARY 1987 </div>	International Searching Authority Australian Patent Office	Signature of Authorized Officer <div style="display: flex; align-items: center; margin-top: 10px;"> T. FAIRALL </div>																							
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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON
INTERNATIONAL APPLICATION NO. PCT/AU 86/00318

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Members			
US	3762779	CA	949624	JP	51023784
WO	8501710	DE	3490480	EP	190134
				NO	852329

END OF ANNEX

A concise explanation of the Japanese Examined Utility Model Application
Publication Sho-46-23526 in light of the present invention in the US Patent
Application No. 10/580,127

Fig. 1 is a perspective view of a belt according to an embodiment of the invention. Fig. 2 is a cross-sectional view of the belt of Fig. 1.

A belt 10 is formed of elastomer and includes a lug 10a. High-tensile-strength cords 10c extending in a longitudinal direction of the belt 10 and reinforcing cords 10b extending in a width direction of the belt 10 are embedded in the belt 10. Openings 10d for engaging sprocket teeth are formed in the belt 10 at even intervals. In these figures, the high-tensile-strength cords 10c and the reinforcing cords 10b appear to be cut off by the formation of the openings 10d.

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